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VISUAL SCREENING OF SCHOOL CHILDREN IN THE MUNICIPALITY OF SAPAREVA BANYA IN SOUTHWESTERN BULGARIA

Slavena Stoykova
Medical Faculty, Sofia University 'St Kliment Ohridsky' Bulgaria, stoykova_sl@abv.bg
Ekaterina Petrova
Medical Faculty, Sofia University 'St Kliment Ohridsky' Bulgaria, ekaterina.petrova030@gmail.com

Abstract: Within 3-days-program almost 200 children and 50 adults had their vision checked by an international qualified team of eye specialists in the local school in Sapareva Banya. Visual acuity, objective and subjective refraction, color perception, binocular vision, cover test, pupillary reaction and other tests were performed. Apart from the ophthalmic examination, all the patients' parents also filled in questionnaire regarding visual strain regimen, previous eye doctor visits and other details. The aim was to promote visual health, establish and possibly treat refractive errors and amblyopia, to facilitate access to specialized medical care, optical and optometrist's service for children's population of remote municipalities with population under 10 000 people. The visual screening of Sapareva Banya school children was of great value because only 38% of children had been examined before. There were no major deviations, severe anisometropia and ametropia values or very low visual acuity patients not wearing optical correction. A surprisingly high incidence of color vision deficiency was found 9, 2% males and 4, 3 % females.
Keywords: school children screening of vision, visual acuity, color vision deficiency, refractive errors, Ishihara, spherical equivalent

INTRODUCTION

Sapareva Banya Municipality is located in Southwestern Bulgaria in the skirts of the Rila Mountain, which is the highest one on the Balkans. It consists of one town Sapareva banya with a population of 3 814 and four villages with population of 3736 or 7540 in total. This number remains relatively constant and is a kind of expectance taking in mind negative demographical indexes in Bulgaria. Ethnical composition shows 95% Bulgarians and 5% Romas which means excellent integration policy results. All four villages have more than 1000 inhabitants implying good social and compact educational structure which meets the requirements of children of all age groups. There are no evidences of closed communities or relatives' marriages.[i]

In 2016 a decision of merging and incorporation was met and only one governmental school left in function – "Hristo Botev". This is a school for students ranging grades 1 through 12 with a 130 year's history and was attended by 426 pupils in 2017, 65 of them in unstable social status. The children were divided into 17 classes with 48 teachers and counselors and no one had left the educational system by that time.[ii]

According to the WHO, screening is defined as the presumptive identification of unrecognized disease in an apparently healthy, asymptomatic population by means of tests, examinations or other procedures that can be applied rapidly and easily to the target population. A screening program must include all the core components in the screening process from inviting the target population to accessing effective treatment for individuals diagnosed with disease.

It is important to avoid imposing models from high-resource settings with advanced health systems on countries that lack the infrastructure or resources to achieve adequate coverage of the population. Screening programmes require significant health resources, infrastructure and functional health systems to be effective. There is no single approach that fits all situations thus necessary adaptations are needed depending on the local context.[iii]

Excellent vision is crucial for child's good physical, mental and emotional development, learning ability and subsequent personal and professional development. Protection of Child's vision is a priority of many international organizations and programs.[iv] Early diagnosis of eye diseases and disorders is of utmost importance during childhood. In Bulgaria there is no functioning system for prophylactic examinations and vision screening of children.[v,vi]

Concentration of children with 6-18 years of age in one school for the whole municipality provided excellent opportunity for covering the target population. Conducting the test in common environment as a classroom and not a medical office, gives more confidence, reduces the anxiety and stress among children. They are more cooperative and concentrated. It also saves time and costs for the parents and promotes visual health.

MATERIALS AND METHODS

Participants:

Initially almost 90% of pupils and their parents declared willingness to participate the screening program and filled up and signed the distributed forms of consent. The event had been planned during first school days right after Christmas holidays. Unfortunately, there was unexpected worsening of weather conditions. Since Sapareva banya is a high-altitude town, it was blocked by heavy snowfall and the school had to remain closed. Children living in neighboring villages could not reach the screening site and dropped out of the program. 203 of 426 school children (47, 65%) passed the eye-screening which is considered a very good result (Fig 1).

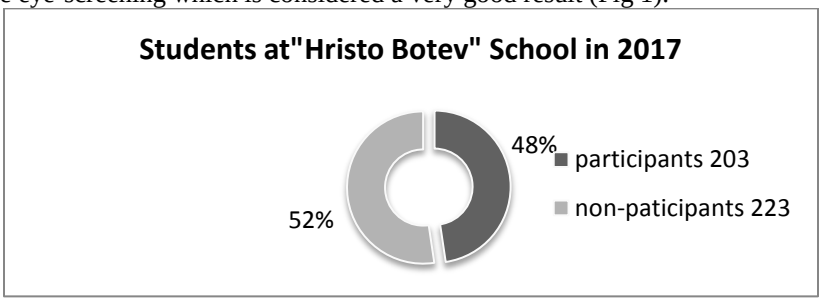

Figure 1. Participation rate of school children

Procedures:

The screening included the following tests:

1. Objective refraction with portable refractometer and retinoscopy when needed
2. Visual acuity and subjective refraction
3. Lang and Randot stereo tests
4. Cover tests
5. Bruckner, Hirschberg and tests for pupillary response
6. Color vision tests- Ishihara, Farnsworth D15 and Lanthony D15
7. Ophthalmoscopy

The screening was performed by qualified team of eye-care professionals - an ophthalmologist, optometrists with bachelor and master's university degree, international teaching optometrists with pediatric practice, observing and training optometry students.[vii,viii] Different tests were divided between specialists and on separate working places, so children did not get distracted or bored. They were able to stay concentrated and cooperative during the whole time. If no major deviation or lack of compliance, average exam time was 10-15 minutes.

RESULTS

This study included 203 individuals in school age, 87 boys and 166 girls (Fig 2).

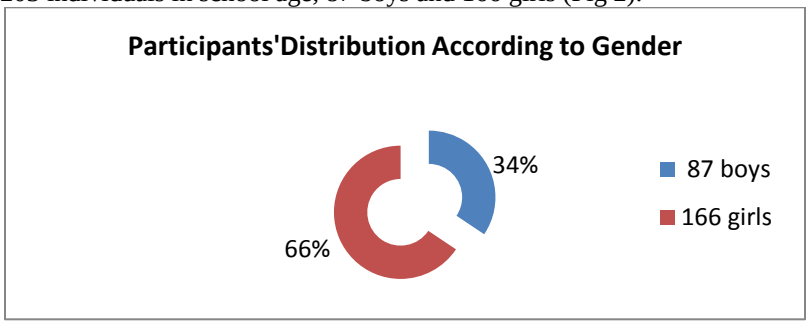

Figure 2. Amount of boys and girls undergone visual screening

The parents had filled up questionnaire at home implying information if their children had some eye examinations in the past and do they have any prescribed glasses.

At the initial point we divided students into two groups. The first one of 124, who had never been to an eye specialist before and the second one- 79 who had been to an eye examination. The results of the current screening showed that 91 of previously examined (44.83%) still do not need glasses, while the other 33 (16.26%) were referred for additional examination.

The present visual acuity tests revealed that among the students who have attended an eye specialist before, 12 (5.91%) without glasses got newly diagnosed with ametropia and 20 (9.85%) students with known refractive errors needed a new prescription.

In the second group of non-tested before individuals, 48 did not need eye correction, while the other 31 were indicated for correction and optical devices (Fig 3).

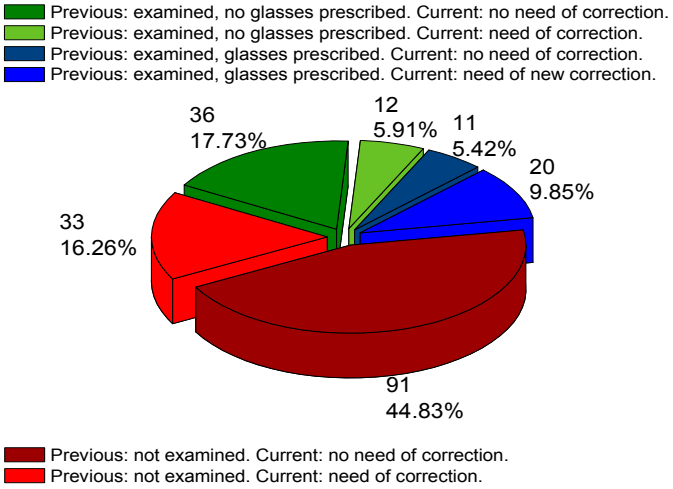

Figure 3. Distribution according to ocular exam history and alteration in refraction status

There were 28 emmetropic children, 128- hyperopic and 47- myopic. (Fig 4). The incidence of severe degree ametropia was not common. To facilitate processing the obtained result and to take in mind the importance of astigmatic correction in some patients, we decided to use spherical equivalent calculation. The spherical equivalent is defined as the spherical power whose focal point coincides with the Circle of Least Confusion of a sphero-cylindrical lens. The Circle of Least Confusion is the midpoint between the two primary focal lines of a sphero-cylindrical lens. The spherical equivalent is calculated by adding the sum of the sphere power with half of the cylinder power.[ix]

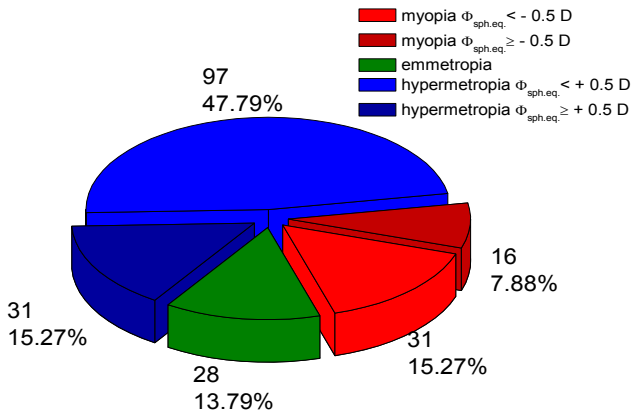

Figure 4. Distribution of ametropia in spherical equivalent values

According to Ishihara plates among the 87 boys and 116 girls, 8 males (9.2%) and 5 females (4.31%) had a red-green color vision deficiency, respectively (Fig 6) and (Fig 7).
The world statistics report about 5% -8% of males and about 0.5% of females having abnormal color perception. The higher prevalence in male population of color perception abnormalities are explained by the X recessive pattern of inheritance. There is marked race distinction described in the literature as shown in Figure 5.

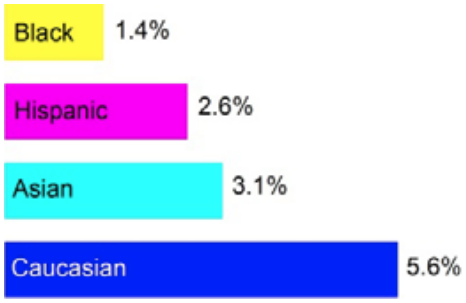

Figure 5. Prevalence of color vision deficiency in boys, by ethnicity.[iv]

In-depth review of the literature, however, shows that authors report for both higher Asian males (11.05%)[xi] and females (0.83%)[x], (2.42%)[xi] color vision deficiencies . No announcements for such extremely high prevalence of female color perception defects are reported as these in Sapareva Banya while male percentages approach close the highest registered.[xii]

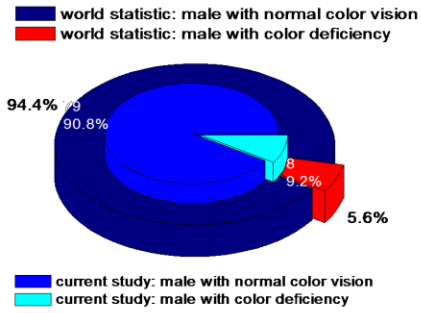

Figure 6. Male color vision deficiencies in Sapareva Banya compared to average international reports

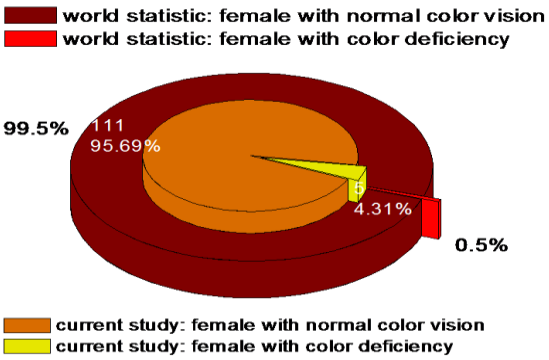

Figure 7. Female color vision deficiencies in Sapareva Banya compared to average international reports

DISCUSSION

The visual screening of Sapareva Banya school children was of great value because only 38% of children had been examined before. There were no major deviations, severe ametropic diopter values or very low visual acuity patients not wearing optical correction. A surprisingly high incidence of color vision deficiency was found 9, 2% males and 4, 3 % females.

In small and remote communities' preschool ocular examination is often being skipped by general practitioners. The value of screening for other visual conditions, such as binocular vision disorders, ocular health problems and refractive errors that are less likely to reduce distance visual acuity, are underestimated so they can be easily missed. Unrecognized color vision deficiencies affect negatively the learning process and future professional orientation. Regular annual eye-exams by ophthalmologists and health care professionals provide best corrected visual acuity and enhances studying performance.

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